FLEXIBLE BROADHEAD ARROW

RELATED APPLICATIONS

The present invention is a continuation-in-part of previous U.S. Patent Application Ser. No. 10/178,243 by the same inventor filed June 25, 2002 which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of archery. Specifically, the invention relates broadhead arrowheads found on arrow devices.

2. Description of the Prior Art

Bowhunting and archery rely on arrows to achieve penetration of the intended target regardless of whether that intended target is a static bulls-eye or a hunted animal. The problem of target penetration has been addressed in several ways. For hunters, target penetration can be directly correlated to the likelihood of hunting success: an arrow that can not adequately penetrate an intended animal is of little use to a hunter. The overall

mass of the arrow could be increased, but more massive arrows are clumsy and must be fired in a high arc to reach the intended target. Simple "field point" arrow tips can provide adequate penetration for straw targets in competition, but they are not very effective for harvesting hunted animals. Prior art broadhead arrows were invented to increase effective hunting penetration and success potential. Typically two to four flat, triangular blades are arranged around the forward pointed tip. As the tip enters the intended target, the blades slice a region much greater than the diameter of the arrow shaft.

Unfortunately, these broad, flat blades have a pronounced aerodynamic effect that can radically affect the overall stability of the arrow in flight and significantly reduce the precision of flight. Since the majority of hunting tips are broadhead in design, the combined effect of broadhead and fletching and/or vanes at opposite ends of an arrow may not promote a stable flight.

SUMMARY OF THE INVENTION

The present invention is a continuation in part of previous U.S. Patent Application 10/178,243 by the same inventor filed June 25, 2002. Application 10/178,243 describes a broadhead arrowhead system wherein a plurality of blades, each including an airfoil design, provides excellent rotation of the arrow shaft during flight without producing a large amount of aerodynamic drag.

A key feature of the present invention is the design of the airfoil blades, wherein the trailing portion of each blade is attached only to the leading portion of each blade and not to the main body or ferrule. When fired into a target, this design enables the flexible blade to collapse as it enters the target such that the leading and trailing portions of each blade are substantially coplanar during penetration. This flexing enables greater penetration than would be available with a rigid airfoil blade design. The invention is compatible with all contemporary arrow shafts.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side perspective of the broadhead arrowhead of the present invention.

FIG. 2 shows a front-end view of the broadhead arrowhead looking rearwardly from the forward end of the arrowhead.

FIG. 3 shows a side detail view of the broadhead arrowhead.

FIG. 4 shows a detailed view of one of the blade assemblies of the arrowhead.

FIG. 4A shows the curvature of the blade assembly at three sections taken along section lines "A-A", "B-B", "C-C", respectively, in FIG. 4.

FIG. 5 shows the broadhead arrowhead mounted to an arrow shaft.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a continuation in part of previous application 10/178,243 by the same inventor. The content of the previous application is incorporated by reference and recited herein.

With reference to FIGs. 1 through 5, the broadhead arrowhead of this invention comprises a body or ferrule

102. At a first, or proximal, end, ferrule **102** incorporates a first end portion **104**. First end portion **104** typically tapers to a point **105**. Ferrule **102** also has a second, or distal, end portion **106**. Second end portion **106** may be slightly flared outwardly. It is not necessary that second end portion **106** be flared outwardly, however. In some embodiments, second end portion **106** may continue substantially straight to the rear end of body **102**. Ferrule **102** is typically symmetrical about a longitudinal axis **118** between first end portion **104** and second end portion **106**.

A mounting stub **108** extends rearwardly from second end portion **106** of arrowhead body **102**. Typically, stub **108** is symmetrical about and coaxial with longitudinal axis **118**. Mounting stub **108** is intended to fit into a mating recess typically located at one end of a standard arrow shaft. Stub **108** may be threaded to mate with matching threads in the arrow shaft recess or it may be seated in the recess in a press fit arrangement. Alternatively, mounting stub **108** may be glued or otherwise sealed into the mating recess of the arrow shaft.

In other variations of mounting means, instead of a stub **108**, second end **106** of body **102** may be hollowed out to fit over an arrow shaft. In such an arrangement, the inside of hollow second end **106** may be threaded to mate with threads on the outer surface of the arrow shaft; or distal second end **106** may be press fit over the arrow shaft. Alternatively, second end **106** may be fitted over the end of the arrow shaft and glued or otherwise sealed to the arrow shaft.

One or more blade assemblies **110** extend laterally outwardly from ferrule **102**. Preferably the arrowhead is constructed with two, three, or four blade assemblies. Typically, if two blade assemblies are used, they are disposed substantially diametrically opposite each other about longitudinal axis **118** of ferrule **102**. Three blade assemblies are typically disposed at angles of approximately 120° around longitudinal axis **118**. Correspondingly, four blade assemblies **110** are typically mounted at 90° angles relative to each other about horizontal axis **118**.

Blade assembly **110** is shown in detail in FIGs. 1 and 4. Each blade assembly **110** comprises a first substantially planar blade assembly portion **112** and a second substantially blade assembly portion **114**. A leading edge **113** of first portion **112** is typically sharpened to better allow the arrowhead to penetrate a target. First blade assembly portion **112** may comprise a solid substantially flat planar portion or optionally may have a cutout section **116**. Second blade assembly portion **114** extends rearwardly from first blade assembly portion **112** at an angle thereto. Second blade assembly portion **114** is preferably curved, with a radius of curvature optimally between about 0.2″ and 0.5″, giving the blade the characteristics of an airfoil. The radius of curvature may vary over the surface of the blade. A trailing edge **119** of the blade is at an angle to arrowhead body **102**. This angle may be as great as 45 degrees or more, but optimally it increases from approximately 5 degrees to approximately 35 degrees at the blade tip. The blades, acting together, form an axial-flow turbine.

As shown in FIG. 3, second blade assembly portion **114** is joined to first blade assembly portion **112** by a continuously curved region **120**. The radius of curvature of region **120** is in the range of between about 0.2″ and 0.5″. An angle θ generally defines the angle between first planar portion **112** and second planar portion **114**. This angle θ is in the range of between about 5 degrees and 25 degrees. This configuration gives the blade assembly an airfoil-type shape. The length of first substantially planar portion **112** is between about 50% and 80% of the total length of blade assembly **110**. Correspondingly, second substantially planar portion **114** comprises between about 20% and 50% of the total length of blade assembly **110**. It will be understood by those skilled in the art that where the arrowhead has more than one blade assembly **110**, each second blade assembly portion **114** is preferably angled relative to each corresponding first blade assembly portion **112** in the same direction and at substantially the same angle for each blade assembly **110**.

Alternatively, first planar portion **112** and second angled portion **114** may be joined at a more sharply defined

angle θ with a radius of curvature close to or at "0". However, this alternative configuration does not produce the same high quality of aerodynamic effects as does the airfoil shape shown in FIG. 3.

FIG. 4A shows the curvature of the blade assembly **110** at three sections taken along section lines "A-A", "B-B", "C-C", respectively, in FIG. 4.

Arrowhead body **102** and blade assemblies **110** may be made of any suitable material, such as, but not limited to, steel, aluminum, plastic, etc. As shown in FIG. 4, first planar portion **112** of blade assembly **110** has a short extension **117** that fits into a slotted opening in body **102**. Extension **117** extends from the inner edge of first planar portion **112** substantially up to but just short of curved region **120**. Extension **117** may be glued, welded or soldered into the slot of body **102**. Alternatively, blade assembly **110** and body **102** may be integrally formed as by molding. Other techniques for securing blade assembly **110** to body **102** would be apparent to those skilled in the relevant arts.

In summary, each blade assembly **110** comprises a substantially flat first planar portion **112** extending laterally outwardly from body **102** and substantially parallel to longitudinal axis **118**. A second blade assembly portion **114** is angled at an angle of between about 5° and 25° out of the plane of first planar portion **112** away from alignment with axis **118** and at an angle of between about 5° and about 45° to the ferrule body **102**. FIG. 2 shows second end portions **114** of each blade angles slightly clockwise relative to the major plane of first planar portion **112**. Alternatively, second end portions **114** can be angled slightly counterclockwise relative to the major plane of first planar portions **112**.

In the embodiment shown, each blade assembly **110** has the general shape of a substantially triangular or delta wing configuration. In other embodiments, blade assembly **110** can have the general shape of a swept wing or a straight wing.

Much like the control surfaces of an aircraft wing, the ratio of angled portion length to overall blade assembly length can be relatively small. For example, in

one embodiment, the ratio of the length of angled second portion **114** to the overall length of blade assembly **110** is in the range of between 10% and 50%, and preferably between about 20% and 50%.

Each blade of the broadhead arrowhead incorporates a substantially similar airfoil that produces a rotational torque about longitudinal axis **118**. In flight, these forces induce a rapid rotation of the arrow about longitudinal axis **118** while minimizing aerodynamic drag. The plane of each blade assembly **110** remains parallel to the shaft of the arrow along its cutting edge **113**.

One of the features of the arrowhead of this invention is its ability to produce stabilized arrow flight without the use of fletching or tail fins (or feathers). FIG. 5 shows the broadhead arrowhead of this invention mounted to an arrow shaft **122** without fletching. Tests have shown that an arrow using the broadhead of this invention without fletching tracks true in flight and does not deviate significantly from the planned flight course. This is due to the rotation induced in the arrow by the aerodynamically designed broadhead blades, which is sufficient to stabilize

the arrow in flight. Eliminating or reducing the size of the fletching in fact improves flight characteristics because the rotational drag normally induced by the fletching is avoided. It should be noted, however, that the arrowhead of the invention can be used with fletched arrow shafts as well.

A key feature of the present invention is the ability of curved region **120** and second planar portion **114** to flex during penetration due in part to the fact that second planar portion **114** and continuously curved region **120** are only integral with first planar portion **112** and not directly integral with body **102**. In the preferred embodiment there is in fact a slight gap **130** between the combination of second planar portion **114** plus curved region **120** and body **102** as shown in FIG. 1. Being manufactured from rigid yet flexible material, such as stainless steel, the blade assemblies **110** of the present invention retain their airfoil shape during release and flight. Aerodynamic forces exerted on blade assemblies **110** during flight are not sufficient to flex second planar portion **114** nor to change angle θ. During impact, first planar portion **112**

enters perpendicular to the target as with any conventional broadhead. As the arrow decelerates, the flexible blade of the present invention collapses such that the angle θ approaches zero degrees as a result of physical contact pressure on the top and bottom surfaces of blade assemblies **110** exerted by the penetrated target. Thus as the arrow decelerates completely, first planar portion **112** and second planar portion **114** become substantially coplanar. This flexing enables greater penetration than would be possible if second planar portion **114** was held in a completely rigid airfoil geometry by attachment to both first planar portion **112** and to body **102**. Such an inflexible broadhead must corkscrew into the target wasting kinetic energy and inhibiting complete penetration of the arrowhead.

An additional benefit of the flexible blade assemblies **110** of the present invention is an increased probability that the arrow will remain buried in the target. Attempts to remove the arrow relieve the physical pressure on flattened second planar portion **114** thereby enabling it to spring back to its airfoil shape, due to the shape memory of materials such as stainless steel, and inhibit backing

out through the same entry path. An arrow that remains buried in a hunted animal debilitates more than just the entry wound itself. In order to forcefully remove the arrowhead of the present invention, an animal would greatly expand the extent of the wound and only further increase the probability of its own demise.

While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.